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AIL1020

Foundations of Statistics & Probability

Instructor

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Module 02 Contd.

Percentiles

Concept of Percentile

Percentile

A **percentile** is a statistical measure that indicates the relative standing of a value within a dataset.

It represents the percentage of data points **that fall below a given value**.

The p^{th} percentile of a dataset is the value below which p% of the data falls.

Example

If a student scores in the **80th percentile** on an exam, it means they performed better than 80% of students but worse than 20%.

In healthcare, if a baby's weight is in the **90th percentile**, it means the baby is heavier than 90% of other babies of the same age.

Concept of Percentile

Quartiles

The p^{th} percentile of a dataset is the value below which p% of the data falls.

The **25th percentile (Q1)** is the value below which 25% of the data lies.

The **50th percentile (Q2 or median)** is the value below which 50% of the data lies.

The **75th percentile (Q3)** is the value below which 75% of the data lies.

These **quartiles** divide the data into four equal parts, making percentiles useful for understanding the spread and distribution of data.

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Concept of Percentile

Percentile

For a dataset with n values sorted in ascending order:

1. Compute the rank index using $i = \frac{p}{100} \times (n + 1)$.
2. If i is an integer, the pth percentile is the value at position i.
3. If i is not an integer, interpolate between the nearest ranked values.

***Example*: Sorted Dataset**

[15, 22, 29, 34, 38, 45, 50, 50, 50, 60, 68, 75, 75, 85, 90, 95]

Quartiles

Example

Data Values
90
32
65
28
45
60
68
85
35
55
78
48
18
52
21
72
37
40
12
25

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Quartiles

Example

Sorted Data
12
18
21
25
28
32
35
37
40
45
48
52
55
60
65
68
72
78
85
90

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Quartiles

Example

Find Q1, Q2, Q3.

Rank	Sorted Data
1	12
2	18
3	21
4	25
5	28
6	32
7	35
8	37
9	40
10	45
11	48
12	52
13	55
14	60
15	65
16	68
17	72
18	78
19	85
20	90

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Quartiles

Example

Find Q1, Q2, Q3.

$n = 20$

Rank	Sorted Data
1	12
2	18
3	21
4	25
5	28
6	32
7	35
8	37
9	40
10	45
11	48
12	52
13	55
14	60
15	65
16	68
17	72
18	78
19	85
20	90

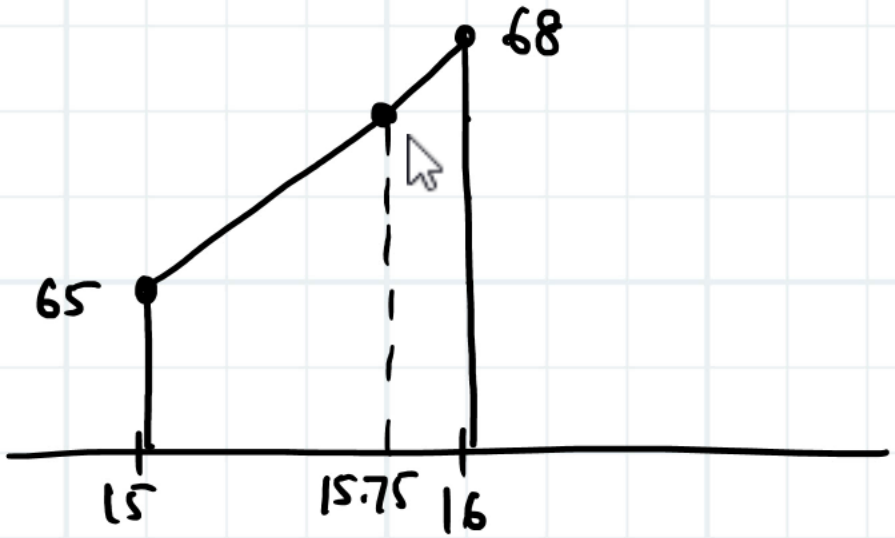
Q1 ---- 29

Q2 ---- 46.5

Q3 ---- ?

Q3 (75^{th} %ile)

$i = \frac{3}{\cancel{75}\ \cancel{100}\ 4}(21) = 15.75$



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Quartiles

Different Methods of Quartile Calculation

Method	Formula	Used By	Best for
$n+1$	$i = \frac{p}{100} \times (n+1)$	Statistics software (NumPy, R, SPSS, etc.)	Continuous distributions, small datasets
$n-1$	$i = \frac{p}{100} \times (n-1)+1$	Excel, Google Sheets	Large datasets, business applications

Quartiles

Example

Find Q1, Q2, Q3.

Rank	Sorted Data
1	12
2	18
3	21
4	25
5	28
6	32
7	35
8	37
9	40
10	45
11	48
12	52
13	55
14	60
15	65
16	68
17	72
18	78
19	85
20	90

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On Google Sheets/Excel

PERCENTILE( )

$$i = \frac{p}{100} \times (n-1) + 1$$

Recap

Percentile represents the percentage of data points **that fall below a given value.**

Quartiles (Q1, Q2, Q3)

Methods of quartile calculation